

DRAFT Flood Resilience

INTRODUCTION

The devastation caused by flooding during Tropical Storm Irene in 2011 was a massive disaster for the Rutland Region and many other areas of Vermont. It also was a turning point. Out of the recovery and rebuilding efforts from Irene came a new goal for the state: flood resilience.

As the Vermont Climate Assessment puts it, the state has “begun to pursue public policy that builds resilience within all 256 towns” (VCA, 2014). Examples of the new priorities include Act 16, the flood resiliency planning statute (24 VSA §4302), as well as new rules for qualifying for state matches for Emergency Relief and Assistance Fund.

The challenge for Vermont communities is “turning vulnerability to resiliency by taking action through adaptation and mitigation,” says the Assessment. *Resilience* being the ability of the Region to effectively plan for, manage and, in a timely manner, recover from flooding. And *adaptation* and *mitigation* as resiliency actions that are two sides of the same coin. Mitigation reduces exposure and vulnerability, and is informed by *past* events. Adaptation reduces exposure and

vulnerability, and is informed by *future* projections.

The focus of this chapter is how flood resilience, mitigation, and adaptation are linked to land use, transportation, education, economic development, as well as many other aspects of regional planning. This chapter is designed to be a tool for town officials, non-profits, developers, and individuals to help make all communities flood resilient and to guide coordination of these actions throughout the Region.

CURRENT CONDITIONS

Types of Flooding

Flooding events are Vermont’s most frequent and costly type of natural disaster. There are two types of flooding that impact communities in Vermont: inundation and flash flooding. Inundation is when water rises onto low lying land. Flash flooding is a sudden, violent flood which often entails fluvial erosion (stream bank erosion). The combination of flash flooding and fluvial erosion cause the most flood-related damage in the state.

Even before Irene, Vermont had been

Tropical Storm Irene



Courtesy: CBS6 Albany



US Rt. 4 in Killington
Courtesy: 22News WWLP



Courtesy: Huffingtonpost.com



Left: Rutland area flooding. Courtesy: VTrans

Right: Brandon flooding. Courtesy: VTrans





Economic Development

Floodplain function protection and fewer disasters help reduce costs/losses, supports public wellbeing, and is needed for enterprise/business continuity.

experiencing more frequent and severe flooding which is projected to continue in the future.

Yet there is a site-specific nature to flooding. Risks can vary site-by-site, to the point where parcels located adjacent to one another may be impacted differently in a flood event. This can be attributed to a number of factors, such as: steep topography; locations of structures on a site; characteristics of the stream or river, including its course and ability to access its floodplain; soil composition; the presence of riparian buffers; and the presence of wetlands nearby and their quality. This site-specific nature of flooding underscores the need for basic systematic steps to protect the ability of streams and rivers to access their floodplains and not cause damage.

Causes of Flooding

Flooding is natural, inevitable and typically beneficial. Flood damage is avoidable.

Because of Vermont's mountainous terrain, rural geography and small

communities with limited transportation routes and communication systems, the state has had a long history in channelizing rivers and streams to maximize agricultural land uses and to facilitate the transportation infrastructure. Channelization, in combination with widespread floodplain encroachment, has led to as much as 70% of Vermont's streams being disconnected from their floodplains (VT Hazard Mitigation Plan, 2013). This is an unsustainable condition, and when energized by flood events, catastrophic adjustments of the channel frequently occur, usually with consequent fluvial erosion damage to adjacent or nearby human investments. Transportation infrastructure and agricultural property are the most frequently endangered types of human investment affected by fluvial erosion hazards. Residential, commercial, utility infrastructure and municipal properties are also frequently endangered.

Implications of Climate Change on Flooding

Gilbert White, considered the father of



FAST FACT

Flood Resilience means the ability of a municipality to effectively understand, plan for functional river corridors and floodplain functions so as to avoid damage and protect public safety and wellbeing.



US Route 4 south of Rutland where the highway is interfering with natural river flow and causing what some landowners believe is an impoundment area. Courtesy: ANR Natural Resources Atlas

floodplain management in the U.S., wrote, "Floods are 'acts of God', but flood losses are largely acts of man." (*Human Adjustment to Floods, 1945*). University of Chicago Department of Geography Research Paper No. 29. Chicago: University of Chicago Department of Geography.) White's views guided floodplain management for decades. But now they may need to be updated since it could be said that floods also are acts of man – because of the effects of greenhouse gas accumulations and climate change, exacerbated in the last 60 years by auto-centric development and infrastructure.

Every county in Vermont announced FEMA disaster declarations in response to flooding events in 2011, the year of Tropical Storm Irene as well as earlier spring flooding. The Vermont Climate Assessment, the first of its kind in the nation, released in June 2014 by the University of Vermont's Gund Institute for Ecological Economics, states that "Climate change is no longer a thing of the future; it is affecting Vermont today." Among the climate trends it says are already

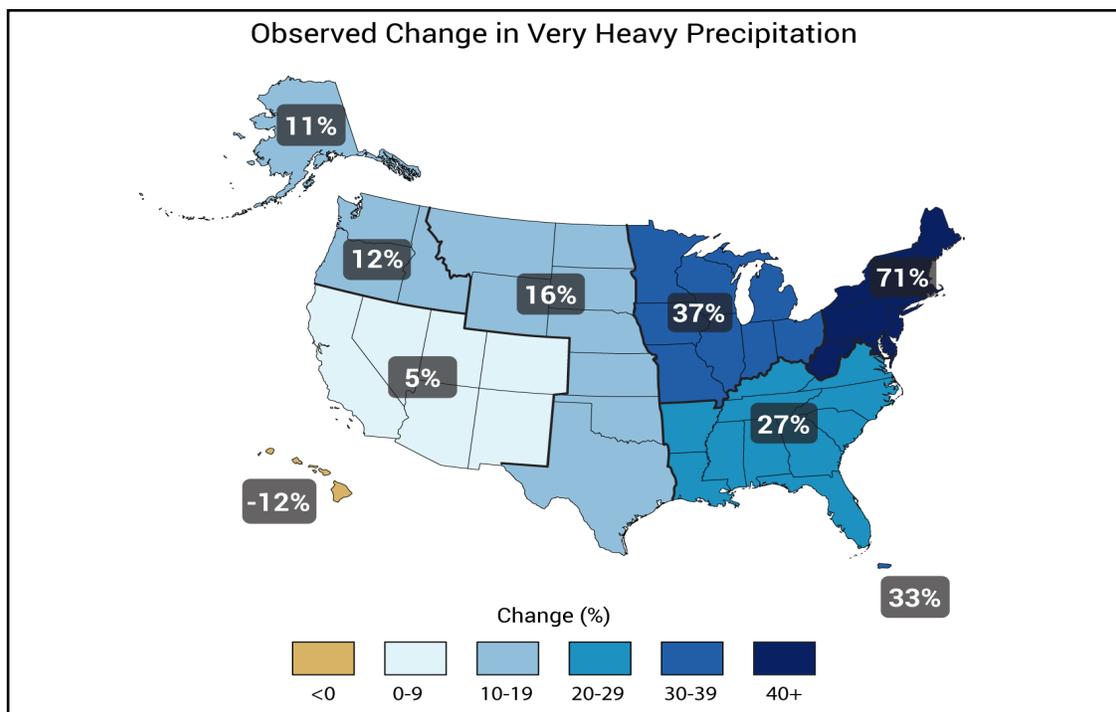
documented in Vermont:

- Rising temperatures: average annual temperature has increased by 1.3 ° F since 1960.
- Increasing precipitation: average annual precipitation has increased 5.9 inches since 1960; almost half (48%) of this change occurring since 1990.
- Extreme events, such as heavy downpours, have become more frequent and/or intense. (*Vermont Climate Assessment, 2014*)

The report's projected trends call for more of the same: even warmer temperatures, more precipitation, and weather extremes. The Vermont Assessment echoes a national one released earlier in 2014. The U.S. Climate Assessment documents heavier downpours increasing nationally, especially over the last three to five decades. The largest increases are in the Midwest and Northeast.

Flooding in the Rutland Region

Flooding (particularly flooding-caused erosion) is the mostly costly natural hazard



Source: US Climate Assessment, 2014



FOOD FOR THOUGHT

Primary Forms of Damage from Flooding and Erosion

- Disrupted Transportation
- Disruption of Government Services
- Economic Loss
- Fast Moving Water
- Landslide/Mudslide/Erosion
- Health Problems
- Toxic Release
- Loss of Utilities
- Building/Structure Collapse

Secondary Effects of Flooding

- Building/Structure Collapse
- Communications Failure
- Explosion/Fire
- Isolated Areas
- Power Outage
- Water Pollution
- Water Supply Disruption

Impact of Flooding on the Community

People:

- Displaced Families
- Loss of Sanitation Services
- Loss of Water Services
- Casualties & Deaths

Property/Environment:

- Air Pollution
- Water Pollution
- Soil Contamination
- Bridges/Roads
- Fire/Explosion

Economy

- Business Interruptions (Permanent/Temporary)
- Loss of Tax Base
- Unemployment (Long/Short Term)

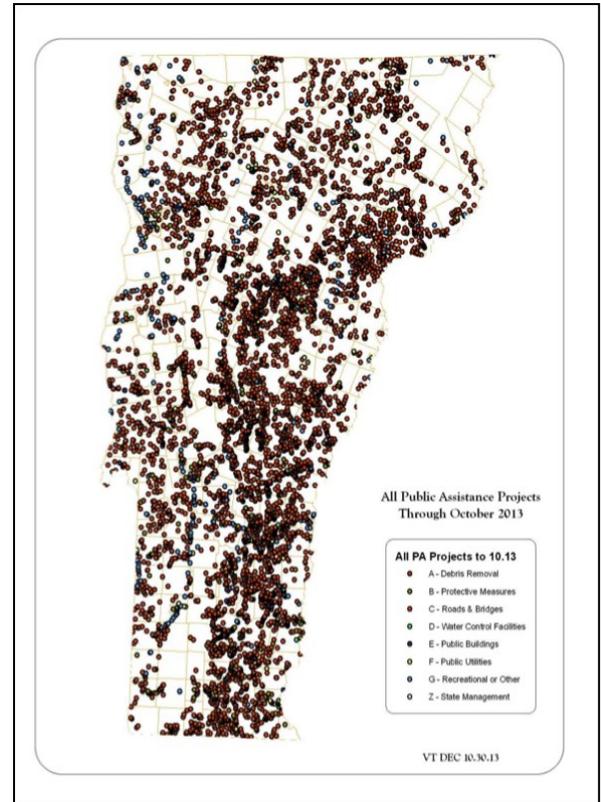
(Rutland Region Mitigation Plan 2011 Update, P 26)

in Rutland County.

Past instances of flooding in the Region have included rain and/or snowmelt events that cause flooding in the major rivers' floodplains and intense rainstorms over a small area that cause localized flash flooding. Both kinds of events can be worsened by the build-up of ice or debris which can contribute to the failure of important infrastructure, such as culverts, bridges, and dams.

In our Region, there is a history of flooding along many of the major waterways. In almost any countywide event, the Otter Creek floods low-lying areas, fields, and roadways. Often the Otter Creek will flood along its entire length affecting Clarendon, Rutland City, Rutland Town, Pittsford, and Brandon. Other rivers that flood are faster moving and more likely to cause extensive infrastructure damage. These include Poultney River, Castleton River, Cold River, Neshobe River, Mill River, Tenney and Moon Brooks. On occasion, Lake Champlain, along the borders of West Haven and Benson, has also been known to flood. (Rutland Region Mitigation Plan, 2011 Update). Please refer to each municipality's Local Hazard Mitigation Plan for floodplain information in the Hazards Analysis and Areas of Local Concern maps.

Significant flooding events have occurred in the Rutland Region throughout recorded history, such as the summer flood of 1811 when extensive economic damages were reported due to the loss of mills, dams, crops and field erosion. Floods also have occurred nearly everywhere in the state. The map in the upper right hand corner shows past infrastructure repair and replacement projects funded with a combination of federal and local recovery funds. Very few areas have escaped disruption and damage, including the Rutland Region.



Regional Economic Impact of Flooding

As noted in the 2013 State Hazard Mitigation Plan, "Flooding is the most common recurring hazard event in the State of Vermont." Several major flooding events have affected the state, resulting in multiple Presidential Disaster Declarations. From 2003 to 2010, Rutland County experienced \$1.4 million in property damages due to flood events (State HMP 2013). The worst flooding event in recent years came in August of 2011 from Tropical Storm Irene (DR 4022), which dropped up to 8 inches of rain in some areas of Rutland County (State HMP 2013). Across the state six Vermonters lost their lives, two of them in Rutland Town. Irene also caused widespread flood inundation and severe fluvial erosion in the Region. As of 2013, the total amount of FEMA Public Assistance funds disbursed throughout Rutland County for Tropical Storm Irene is \$11.8 million. FEMA has also disbursed Individual Assistance payments of \$1.6 million in home repair assistance, \$303,317 in rental assistance, and \$155,921 in other needs assistance

throughout Rutland County (State HMP 2013). All told, Irene cost the state at least \$850 million. Far more damage was not insured or reimbursed.

Other Presidential Disaster Declarations related to flooding occurred for Rutland Region:

- April 2007 – DR 1698 (Severe Storms and Flooding)
- December 2000 – DR 1358 (Severe Winter Storm)
- July 2000 – DR 1336 (Severe Storms and Flooding)
- September 1999 - DR 1307 (Tropical

- Storm Floyd)
- June 1998 – DR 1228 (Severe Storms and Flooding)
- January 1996 – DR 1101 (Storms and Flooding)

Floodplain Mapping

Because flooding and flood damage are spatial in nature, we can begin to identify areas in the Rutland Region that are most vulnerable to flooding through mapping analysis. By compiling flood data from multiple events over time, we can begin to see the areas that are consistently flooded with little damage to life and property, and

Significant Flood Events in Rutland Region in last 10 Years

Property Damage (Adjusted for Inflation)	Dates	Remarks
At least \$ 13,859,238.00	8/28-29/2011	Tropical Storm Irene
\$ 41,600.00	10/1/2010	
\$ 2,080.00	3/23-24/2010	
\$ 79,591.84	7/29/2009	Flash Flood
\$ 105,050.51	8/6/2008	Flash Flood
\$ 105,050.51	6/28/2008	Flash Flood
\$ 787,878.79	6/14-15/2008	Flash Flood
\$ 21,894.74	6/12/2007	Flash Flood
\$ 62,173.91	1/18/2006	Flood
\$ 11,555.56	4/3-4/2005	Flood
\$ 35,862.07	8/12/2004	Flood
\$ 5,977.01	7/31/2004	
\$ 11,954.02	5/24/2004	
\$ 2,390.80	4/2/2004	
\$ 1,857.14	12/25-26/2003	
\$ 2,476.19	10/29/2003	
\$ 30,952.38	7/24/2003	
\$ 37,142.86	4/13-14/2003	

Source: State of Vermont Hazard Mitigation Plan, 2013



FAST FACT

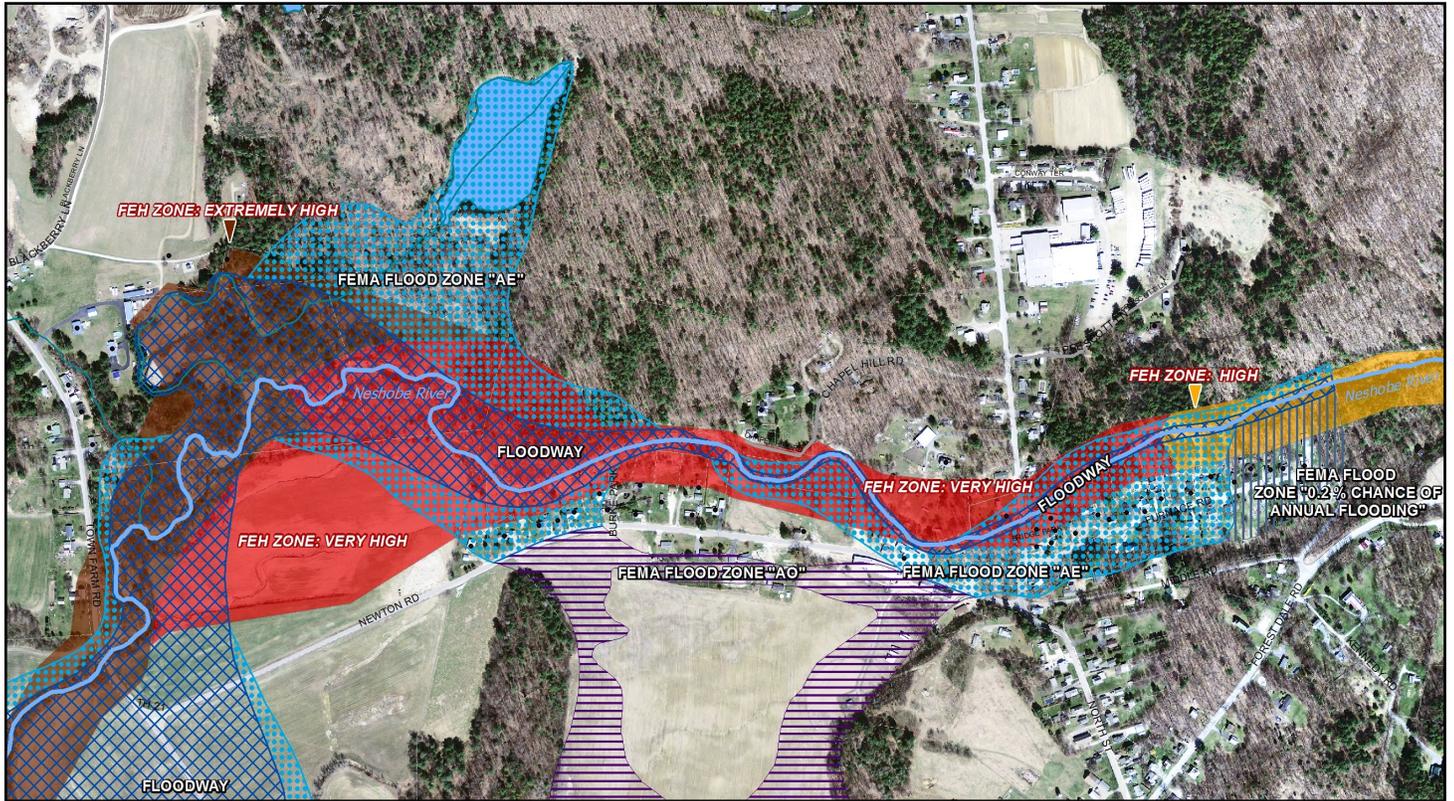
The National Flood Insurance Program (NFIP) was created by Congress to provide private property owners with a means of getting insurance against flood losses.

Flood insurance rates are based on Flood Insurance Rate Maps (FIRMs) or Digital Flood Insurance Rate Maps (DFIRMs). Delineated on these maps are Special Flood Hazard Areas (SFHA) or areas with a 1% annual chance or more of flooding (100 year flood). The common term "100 year flood" is misleading since such floods can occur in multiple years.

Participation in the NFIP is based on an agreement between local communities and the Federal Government that states that if a community will adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses.

Town participation in NFIP is voluntary.

Brandon Floodway FEMA Special Flood Hazard Areas and fluvial erosion hazard (FEH) zones



DEFINITIONS

FEMA Special Flood Hazard Areas (SFHAs)

Zone A: areas subject to inundation by the 1% annual chance flood event. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.

Zone AE: areas subject to inundation by the 1% annual chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown within these zones.

Zone AO: areas of shallow flooding where the potential run-up is less than 3-feet above an overtopped barrier crest.

Base Flood Elevation (BFE) : the elevation of the water surface resulting from a flood that has a one percent chance of equaling or exceeding that level in a given year.

which areas have repeatedly sustained significant flood damage.

There are two sets of official maps which can govern floodplain development in Vermont. They are the Federal Emergency Management Agency's (FEMA's) Flood Insurance Rate Maps (FIRMs) and the Vermont Agency of Natural Resources' (ANR's) river corridor maps. These maps can be used together to avoid direct losses from flood and erosion and to enable the river to become less powerful and damaging.

The FIRM shows the floodplain that FEMA has calculated which would be covered by water in a 1% chance annual inundation event, also referred to as the "100 year flood" or base flood. This area of inundation is called the Special Flood Hazard Area (SFHA). FIRMs also may show expected base flood elevations (BFEs) and floodways (smaller areas that carry more current). Every municipality in the Rutland Region except Killington has flood risk areas mapped by FEMA. FIRMs are only prepared for larger streams and rivers. Flood hazards near larger populations are

often studied by detailed methods. In more rural areas the maps may be done by approximate Zone A methods. Flood plains on smaller sources or more remote locations are often not mapped.

Remarkably, two thirds of flood damages in Vermont occur outside of federally mapped flood areas. Most of the damage in Vermont is to roads, culverts, bridges, and sometimes houses being damaged by the erosive power of moving water - not by getting wet.

Since FEMA maps in the Region are only concerned with inundation, flash flooding and erosion areas are often not required to have flood insurance. Flash flooding in these areas can be extremely erosive, causing damage to road infrastructure, streambeds and mountainsides, and even landslides. Undersized or blocked culverts can lead to further erosion and streambank or mountainside undercutting.

Vermont ANR's river corridor maps on the Natural Resources Atlas show the area where the river channel will adjust over time in response to the water, energy,

sediment and debris in the watershed. Inside of this area there is a higher likelihood of erosion, but most importantly, this is the area that the river needs to accommodate its load, slow down, and continue to access its floodplain so as to not cause more damage to roads and buildings downstream.

In these areas, the lateral movement of rivers and associated erosion are more of a threat than inundation floodwaters. Elevation or flood-proofing alone may not be enough protection in these areas as erosion can undermine structures. River corridor maps are now available across the Rutland Region. Where unmapped (streams with a watershed of less than two square miles), the river corridor dimension can be protected with a 50 foot setback from the top of bank/top of slope. The maps will be updated as the RRPC works with communities to secure field-based data. Visit Flood Ready Vermont (www.floodready.vermont.gov) to learn more about how river corridors relate to fluvial erosion hazard areas and Special Flood Hazard Areas.

Flood Hazard Regulations

Most communities in the Rutland Region have flood hazard regulations and participate in the National Flood Insurance

Program. These were updated before the effective date of the Rutland Digital Flood Insurance Map in 2008. Since that time new model regulations have become available to encourage communities to protect river corridors and require “no adverse impacts” from development in Special Flood Hazard Areas. At this time, three towns in the Rutland Region do not participate in NFIP: Tinmouth, Killington and Mount Tabor.

Repetitive Loss Properties in Vermont

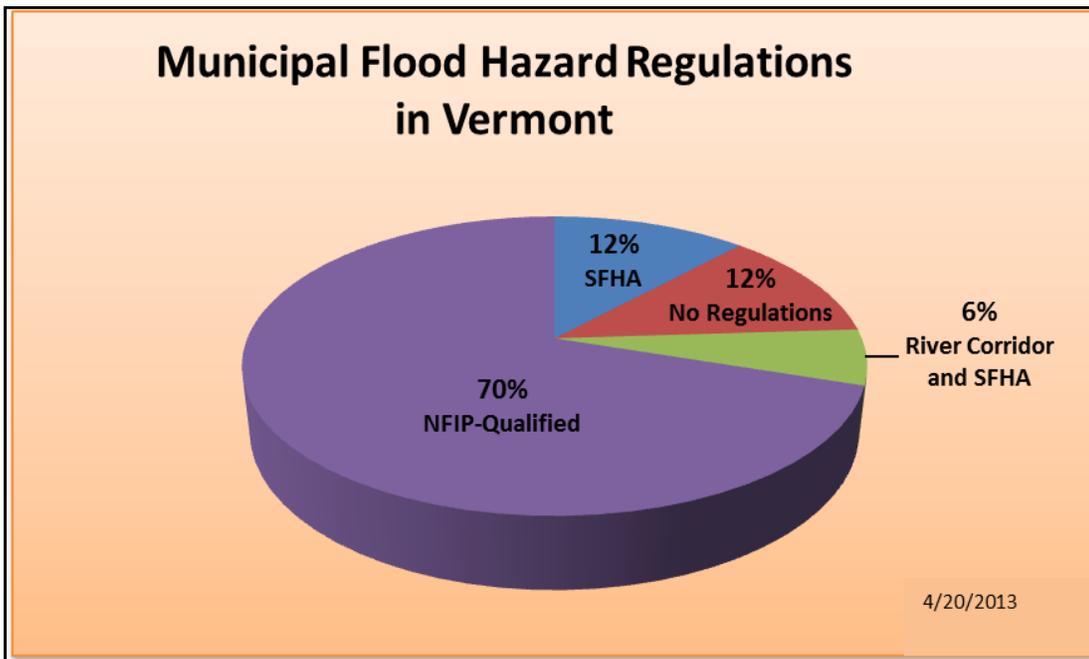
There are also areas within Vermont that present significant losses but do not fall under the FEMA definition of a repetitive loss property.

Repetitive loss structures are a serious concern from a mitigation standpoint. Tropical Storm Irene greatly increased the number of repetitive loss properties in the State of Vermont. According to the 2010 state HMP, there were 65 non-mitigated multiple loss properties in 33 Vermont towns. Currently, there are 139 non-mitigated multiple loss properties in 45 communities. In our Region, the state lists 22 multiple loss properties in Rutland City multiple and two in Rutland Town – the only ones in the county. For example, Clover Street in the City of Rutland is



Emergency Management

This plan is designed to be used in the development and implementation of community Local Emergency Operations Plans, Local Hazard Mitigation Plans, and capital improvement plans.





FAST FACT

Tinmouth Channel

In 2001, the Tinmouth Channel wetlands complex was upgraded to a Class I wetland, which affords it the state's highest protection.

The Tinmouth Channel flows into the Clarendon River between Mountain View Road and East Road in Tinmouth and covers 450 acres comprised of wetlands and forest habitat.

This is one of only three wetlands in Vermont to receive a Class I designation. The other two Class I wetlands are Dorset Marsh in Dorset and North Shore Wetland in Burlington.

Wetlands, such as Tinmouth Channel, function as floodplains and are often identified as Special Flood Hazard Areas on FIRMs.

repeatedly flooded by Moon Brook after major rainstorms. However, that number is expected to rise as more data become available.

Property Buyouts

Following the flood damage in 2011 caused by spring flooding and Tropical Storm Irene, a number of property owners in Vermont applied for property buyouts, funded by FEMA's Hazard Mitigation Grant Program (HMGP) and Housing and Urban Development's (HUD's) Community Block Grants for Disaster Recovery (CDBG-DR). Typically, such funding requires that structure(s) on each buyout property be demolished and ownership transferred to the municipality. Future development on these sites is restricted. Three properties in the Rutland Region were approved for buyouts: one each in Brandon, Clarendon and Danby.

The buyout process can have be an effective way to reduce a community's vulnerability to future flooding and can improve the community's overall resilience to flooding.

One consequence of home buyouts is the loss of a community's housing base, and sometimes, from the community's affordable housing base. Oftentimes, affordable or low-income housing is located in areas at a high risk for flooding. If the housing base is affected, it is important for the community to have a thoughtful and creative approach to rebuilding its housing base. This will maintain its improved flood resilience, along with providing affordable and safe housing for residents.

Lands Which Help to Prevent Flooding

Watershed Resources

Mapping river corridors is not just about identifying hazards and better understanding the physical processes and watersheds, but such assessments also aid communities in making knowledgeable and strategic decisions about how to best

protect, manage, and restore watershed resources. Wetlands prevent flood damage and are a vital component for maintaining the ecological integrity of land and water. Riparian buffers reduce flood hazards and stabilize stream banks, attenuate floods, provide aquatic and terrestrial habitat and wildlife corridors, filter runoff, absorb nutrients, and shade streams to keep them cool. In addition, upland forests moderate flood impacts and attenuate flood impacts.

Wetlands

The benefits provided by wetlands include flood and stormwater control, maintenance of surface and ground water quality, open space and aesthetic appreciation, fish and wildlife habitat, ecological research and educational opportunities, and sources of nutrients for freshwater food chains. Such areas include but are not limited to marshes, swamps, sloughs, potholes, fens, river and lake overflows, bogs and ponds.

Draining, filling and development have resulted in the loss of more than 35% of Vermont's original wetland acreage, primarily due to agricultural and large-scale development projects. At present, roughly four percent of Vermont's lands are classified as wetlands, totaling 244,000 acres.

The Vermont Wetlands Rules (10 VSA Chapter 37) classify wetlands into three categories. Class I wetlands are those identified as "exceptional or irreplaceable in their contribution to Vermont's natural heritage." The 450-acre Tinmouth Channel is one of only three Class I protected wetlands in Vermont. Class II wetlands, also considered significant by the state, generally have areas of at least three acres. Class III Wetlands are those that have not been evaluated or are not considered by the Water Resources Panel of the Natural Resources Board (formerly Water Resources Board) to be significant.

CASE STUDY: OTTER CREEK'S NATURAL RESILIENCY

During Tropical Storm Irene, the community of Rutland in Addison County was spared devastating flooding, despite the fact that the Rutland Region basin incurred substantial damage during the storm, including major damage to roads and bridges. Why was this?

It's because the Otter Creek Basin and Watershed worked like a natural system should: dramatically spreading, slowing and sinking floodwaters. At the height of Irene, Otter Creek flooded Rutland with the highest flow ever recorded for that location, perhaps comparable to the flood of 1927 (which occurred before official river flow data collection on the Otter Creek). During Irene, even though the Otter Creek flood flows peaked at approximately 19,000 cubic feet per second (CFS) in Rutland, 33 miles downstream when the peak came the flow was only 7,000 CFS. Upstream where communities and the river have little access to a flood plain, the river's volume increased by nearly twenty fold in one day's time.

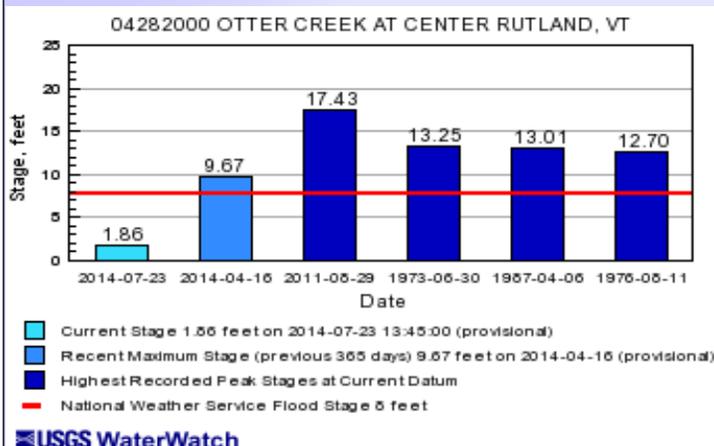
What's noteworthy about the Otter Creek during Irene is in most rivers, flood peaks increase as the water moves downstream and collects water from other streams in the watershed. Not so in the Otter Creek Basin and Watershed. This floodplain between Rutland and Middlebury is broad and flat, with an extensive complex of wetlands and swamps. Irene's floodwaters spilled over into this complex, filling the broad, low-lying Otter Creek floodplain with water. Only gradually did this water flow back out of the swamp and into the river, resulting in a markedly diminished peak flow in Middlebury com-

pared to Rutland and minimizing damage to homes and property downstream.

The crest came and went suddenly. But down river in Middlebury, the crest came days afterwards. And instead of seeing a drastic and dangerous increase in volume, Middlebury residents saw the Otter Creek grow at a slower and safer pace. It receded gradually over most of September. (Marangelo, The Nature Conservancy, Vermont Chapter)

Because of this well-functioning watershed, peak flows in the Otter Creek watershed were substantially reduced downriver of the basin. "The difference was due to acres of swamps, with tall trees emerging from beds of cattails, and broad floodplains with comparatively little development on the riverbanks. These natural features functioned, as nature intended, like a massive sponge, sopping up, slowing down and weakening the flood's destructive force. Especially after Irene, we know that the key to flood protection lies in giving rivers room to move, keeping flood plains intact and building roads and bridges that are ready for our new climate." (Porter, *Irene and Flood Protection*, VPR, 8-21-12)

Although most watersheds in Vermont exist in narrow valleys that limit the ability of floodwaters to spread into wetlands and floodplains, what happened along Otter Creek shows the benefits of protecting and preserving natural defenses against floods. Using the Otter Creek example, there have been other efforts to increase wetlands designations in the Region to enhance basins and watersheds. For instance, the Nature Conservancy has been modeling and mapping active floodplain areas and incorporating this information into river corridor conservation work in pilot projects in the Lewis Creek and the Poultney River watersheds, to help protect habitat and increase flood resilience.



Riparian Buffers and Lands Adjacent to Streams

Naturally vegetated riparian zones (adjacent to surface waters) are essential for healthy and resilient river corridors. These vegetated buffers provide floodwater attenuation; habitat for aquatic and terrestrial organisms; river bank support and stabilization; help prevent bank undercutting and bank collapse; reduce flood and ice damage to stream channel and adjacent lands and structures; shade the river channel; intercept, absorb and filter pollutants; and slow surface water runoff.

Outside of the riparian buffer, lands adjacent to streams also provide benefits, especially during flood events. Once water overtops the river or stream channel, these areas help to dissipate flood water. This also slows the velocity of the water. Although much of the region is steep and mountainous and does not have an abundance of flat lands surrounding streams and rivers, the importance of these lands were demonstrated during Tropical Storm Irene.

These streams are notoriously “flashy” and experience fluvial erosion, especially in mountainous areas.

Because of the importance of upland forests, sound logging practices should be encouraged and the development of roads discouraged to protect what are in many cases are intact ecosystems.

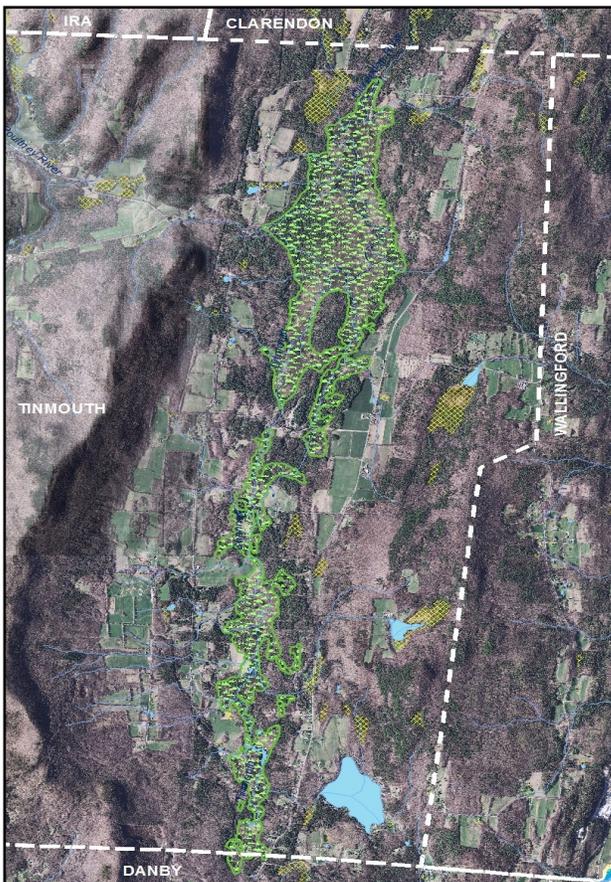
Stormwater, Impervious Surfaces, and Green Infrastructure

Because impervious surfaces prevent the infiltration of water into the soil, these man-made surfaces exacerbate flooding by increasing the amount and velocity of stormwater runoff, particularly in areas where these surfaces are prevalent. This stormwater adds to the “flashiness” of localized flooding, especially in heavy rain events. Man-made impervious surfaces include parking lots, rooftops, roads (even gravel roads), and severely compacted soils. Stormwater runoff picks up debris, chemicals, sediment or other pollutants on impervious surfaces. A heightened slug of stormwater also accelerates erosion and phosphorus runoff where it discharges.

The percentage of impervious surfaces can be reduced by limiting the number of rooftops and pavement, by using permeable surfacing materials, employing disconnection practices, and by implementing Low Impact Development (LID) and “Green Infrastructure” principles.

Although the terms “LID” and “Green Infrastructure” are often used interchangeably to include principles that mimic conditions present before the development of an area, there is a slight technical difference between the two terms. LID refers to the process of designing and implementing practices that can be implemented at the site-level to control stormwater and attempts to replicate the pre-development conditions at that site. Green Infrastructure refers to a broader view at the community or watershed scale, and is focused on implementing LID practices as part of a coordinated effort to reduce impervious surfaces and stormwater runoff. They

Tinmouth Channel Wetland Complex



Upland Forests

By definition, upland forests contain a nearly continuous canopy cover of 60% or more. Upland forests also comprise many small streams which make up the headwaters of watersheds. Activities occurring in the headwater streams can impact an entire watershed.

Healthy and well-managed upland forests and reduce flooding by intercepting rainfall and infiltrating rainwater, thereby slowing the flow of rainwater into small, headwater streams.

include porous pavement, bio-swales, “green” landscaping, vegetated buffers, rain gardens and rain barrels.

Because stormwater has a profound impact on flooding, the state of Vermont has regulations in place to control stormwater on larger projects and problem areas, such as discharge permits.

While widespread impervious surfaces are detrimental to water quality, impervious surfaces in some areas, such as village

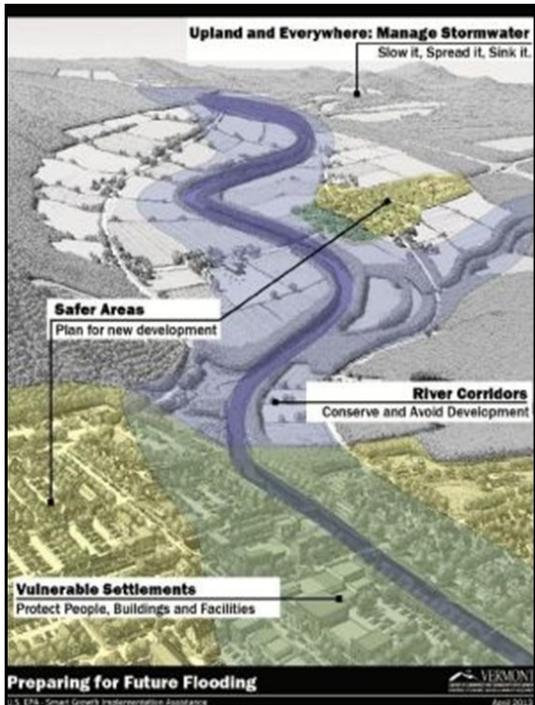
centers and downtowns, are the result of historic settlement patterns as well as dense development. Because this landscape is important to the fabric of Rutland Region, it is critical to maintain the denser development patterns of village centers and downtowns. However, it also is important to understand stormwater runoff issues and how to mitigate their effects, even in these areas of dense development.

Connection to Act 250/Section 248 applications

In participating in Act 250 and Section 248 application processes, the Rutland Regional Planning Commission recognizes that development and new energy projects can negatively impact flood resiliency. Because of that, the RRPC will not support any development or new gas and electric purchases, investments, and facilities in the river corridor and flood zones in the Region. Please refer to Hazard Analysis and Areas of Local Concern maps in Local Hazard Mitigation Plans for SFHA and FEH zone locations in specific communities and to Natural Resources maps (1 & 2) in individual town plans.

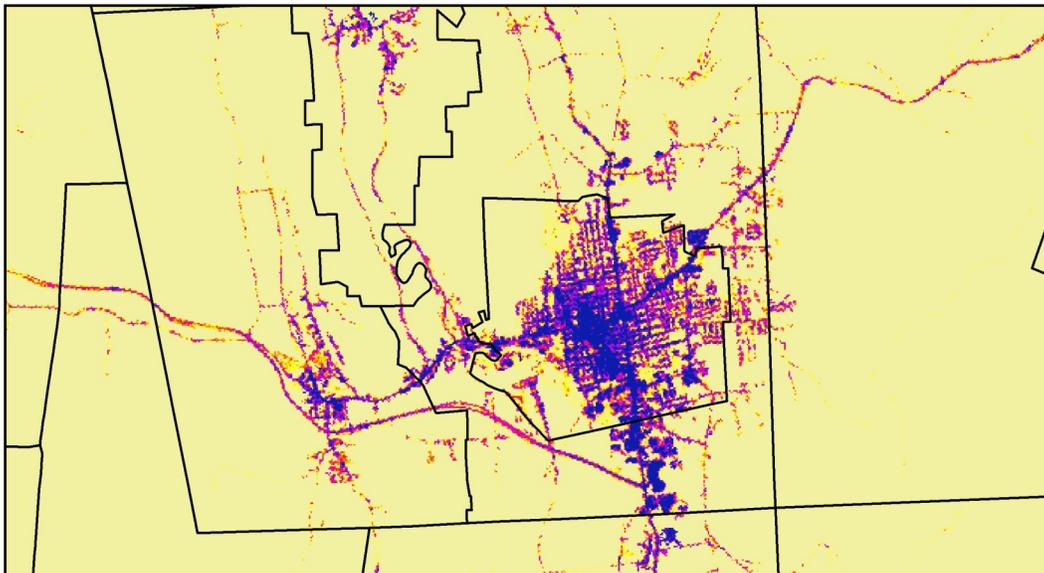
Legal Implications

There are potential legal implications for not adopting flood regulations. Courts throughout the nation, including the U.S.



Spread It, Slow It, Sink It

Impervious Surfaces in Rutland, West Rutland and Proctor



FOOD FOR THOUGHT

The Five Steps for Resilience Planning

1. Assess Hazards and Assets
Identify mapped floodplains, river corridors and other landscape features that moderate flood damage.

2. Avoid Increasing Risk
In Vermont most communities have some development regulations through zoning or as stand-alone regulations to address flood hazard areas.

3. Reduce Current Risk
Identify, prioritize, and adapt critical facilities and public infrastructure to become more resilient, support equilibrium conditions, and to reduce risk of damage.

4. Prepare for Emergency
For the purposes of coordinating local response and working with other towns and agencies, the community should have an up-to-date Local Emergency Operations Plan (LEOP).

5. Insure Residual Risk
Is the use of flood insurance adequate? Roughly two-thirds of the structures in the high risk Special Flood Hazard Area in Vermont do not carry flood insurance. Also many structures may not be fully insured to receive “replacement value” after a disaster.

(VT Agency of Natural Resources)



FAST FACT

Association of State Floodplain Managers' No Adverse Impact Policy

"No Adverse Impact Floodplain Management" is a managing principle that is easy to communicate and, from legal and policy perspectives, tough to challenge.

In essence, No Adverse Impact floodplain management takes place when the actions of one property owner are not allowed to adversely affect the rights of other property owners.

Supreme Court, have consistently shown great deference to governments acting to prevent loss of life or property, even when protective measures restrict some uses of private property.

Recent decisions confirm that:

- Communities have the legal authority to manage flood risks and development;
- Communities have the legal responsibility to do so, and may be liable for any harm resulting from failure to exercise that responsibility;
- Property owners who increase flooding or erosion, or violate reasonable watershed or floodplain standards, are intruding on the property rights of others. The community is seen as the first line of defense against this intrusion.

UNMET NEEDS

Current gaps in the Rutland Region regarding flood resiliency:

- Need for additional state grants and loans or self-insurance to cover the costs of disaster recovery.
- Three municipalities are not part of National Flood Insurance Program which in return for adopting floodplain regulations, the federal government makes flood insurance available to the citizens of a community, even those located in a floodplain.
- Several communities in the Rutland Region (Shrewsbury and Brandon) are currently recognized as providing protection for river corridors. The RRPC will support efforts by participating communities to update their bylaws to address no adverse impact to river corridors and floodplain.
- Municipalities with critical infrastructure in floodplains, including older structures, roads, and bridges. Some of these features are noted on the Expanded Community Reports at Flood Ready Vermont. Structure data

for culverts and bridges may be available where river corridor plans have been completed.

- Lack of municipal and regional planning to address roads and transportation and other critical infrastructure endangered by flooding.
- Town roads and culverts that are at risk because of their location in floodplains. Very undersized culverts and other needs identified in Local Hazard Mitigation Plans may be eligible for funding to upsize them.
- Roads susceptible to closure due to repetitive flooding.

Refer to Areas of Local Concern maps and LHMPs for town roads in floodplains.

FUTURE TRENDS

To continue to be eligible for state and federal disaster relief and be prepared for heavier precipitation projections, communities in the Rutland Region are being asked to become more flood resilient. Among the key trends:

Increased Federal and State Attention and Incentives to Address Flood Hazards

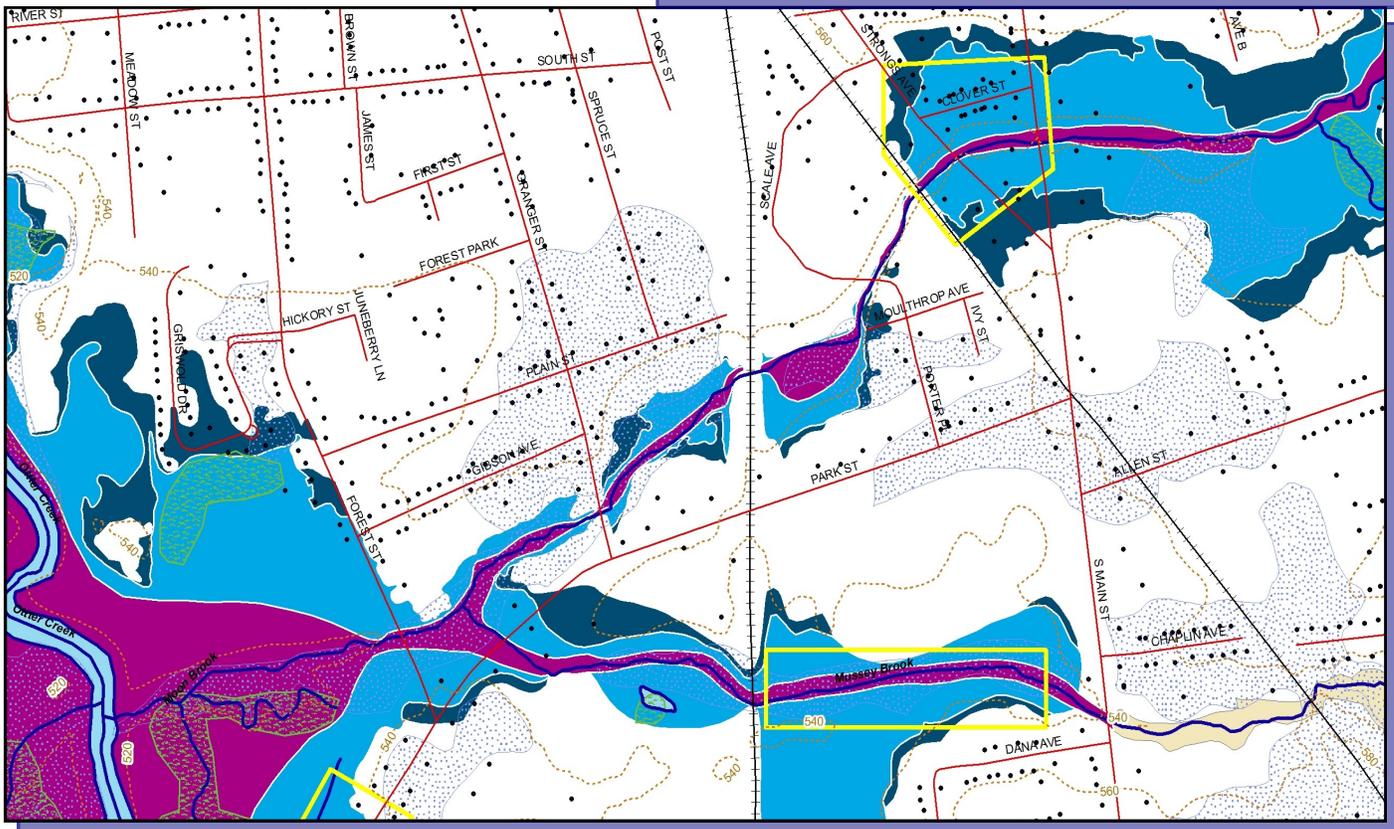
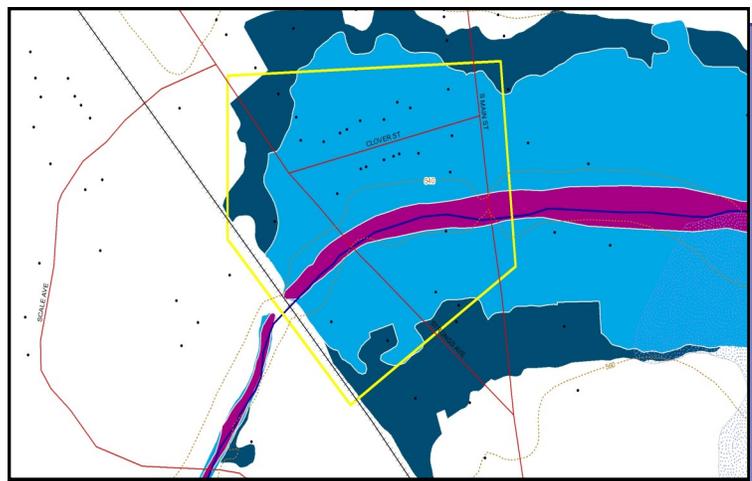
- Vermont is "encouraging" more flood planning by linking the Emergency Relief Assistance Fund (ERAF) to certain flood resilience actions (such as Local Hazard Mitigation Plans, National Flood Insurance Program (NFIP), Town Road and Bridge Standards, Local Emergency Operations Plans (LEOP), and protection for river corridors. The RRPC should encourage the integration of Region Hazard Mitigation Plan and individual community Local Hazard Mitigation Plans with Regional and Municipal Plans to facilitate flood planning.
- Vermont is offering more resources and technical assistance for communities to plan for future flooding. Website: *Flood*

Ready Vermont : Community Pressure to Move Infrastructure out of Floodplains
www.floodreadyvermont.gov

- FEMA’s Hazard Mitigation Grant Program recently relaxed the need for a Benefit-Cost Analysis for buyout and elevation changes for properties in floodplains.
- “Know Your Line: Be Flood Aware High Water Mark Initiative” created by FEMA and seven other federal agencies, this program encourages participating communities to post high water mark signs in prominent places, hold a high profile launch event to unveil the signs, and conduct ongoing education to build local awareness of flood risk and to motivate people to take action. Montpelier launched a version of this program in 2014.
- It is important to steer new public (and private) investments to safer locations. Many towns in Vermont, including some in the Rutland Region, have older structures, roads, bridges, and sometimes critical facilities built in the flood hazard area. Yet few communities have adequate financial resources to provide for public safety during flood events. Communities will be encouraged to include flood

Streets Susceptible to Closure Due to Repetitive Flooding in the City of Rutland (outlined in yellow)

Inset: Clover St.



Post-Disaster Checklist

In the Event of a Disaster

Municipal officers should report all damages to DEMHS as quickly as possible in order to receive a determination from DEMHS and VTrans as to whether the damages qualify for federal assistance:

- Vermont Division of Emergency Management and Homeland Security 1-800-347-0488
- Local Agency of Transportation District Administrator. District 3 Rutland 802-786-5826

And use your Local Emergency Operations Plan!

Post-Disaster Funds

Several sources of funding may become available after a disaster. The most important source of support for municipalities is federal Public Assistance (PA). After a disaster it is important to **keep good records**. Photograph and document losses and costs.

Public Assistance and FEMA Programs

The single most important source of post-disaster funding for municipalities is federal Public Assistance (PA) administered by FEMA after a federally-declared disaster. PA funding covers at least 75% of qualified damage to public assets such as roads and culverts. As of 2014, the **Public Assistance Program in Vermont** is managed by the State Public Assistance Officer at the Department of Emergency Management and Homeland Security: <http://vem.vermont.gov/publicassistance>

Federal Individual and Households Assistance – (FEMA IHA) - This is a site for individuals seeking assistance after a disaster and links to additional resources including loans through the Small Business Administration: <http://www.fema.gov/apply-assistance>

FEMA Hazard Mitigation Grants (HMGP) - These federal grants are available after a disaster to help reduce (mitigate) the impact of future disasters. These grants are available in communities that have a Local Hazard Mitigation Plan and can provide up to 75% of qualified project costs: http://floodready.vermont.gov/find_funding/hazard_mitigation_assistance

Vermont ERAF / Emergency Relief and Assistance Fund

The Vermont Emergency Relief and Assistance Fund (ERAF) supplements federal Public Assistance. After October 23, 2014, communities that have already taken specific mitigations steps will be eligible for 12.5 % or 17.5% funding from the State:

http://floodready.vermont.gov/find_funding/emergency_relief_assistance

Look up your community's ERAF reimbursement rate: http://floodready.vermont.gov/assessment/community_reports

VTrans – Town Highway Disaster Assistance

- VTrans offers assistance to municipalities before, during and after disaster events that affect town highways. This support is described in Section 6 of the VTrans Orange Book.
- A structure crossing a stream or river needs a permit from an ANR River Management Engineer:
- http://www.watershedmanagement.vt.gov/rivers/htm/rv_management.htm confirming that the span will accommodate at least 1.2 times the bank full width and not obstruct geomorphic equilibrium.
- See Roads and Culverts for more on reliable roads. Any structure replaced after a disaster must meet this standard.
- VTrans administers the Federal Highway Administration's Emergency Relief (ER) Program (See Orange Book p.6-6) support for specified Federal-Aid Highways including some maintained by municipalities. These roads are typically built to a higher standard than most municipal roads and experience less damage. Work through DEMHS and your VTrans District Administrator regarding these funds.

Insurance

- Homeowners' insurance will not cover losses due to flooding. Flood insurance can help cover the cost of damage to buildings and their contents from the effect of overland flow. Flood insurance through the National Flood Insurance Program (NFIP) is available anywhere in a community that participates in the program: http://floodready.vermont.gov/find_funding/flood_insurance
- Flood insurance needs to be acquired before the disaster. It does not require a disaster declaration.
- After a loss, an insured structure in the Special Flood Hazard Area can also access \$30,000 in funding to help meet the Increased Cost of Compliance (ICC) by elevating, relocating, demolishing, or flood-proofing as needed to comply with community hazard regulations: <http://www.fema.gov/national-flood-insurance-program-2/increased-cost-compliance-coverage>
- In Vermont many municipalities secure insurance for themselves through the Property And Casualty Intermunicipal Fund (PACIF) program offered by the Vermont League of Cities and Towns (VLCT). PACIF covers flood losses for municipal structures. Contact VLCT for more information: <http://www.vlct.org/rms/pacif/>
- Municipalities should plan to safely locate irreplaceable legal and historic documents and artifacts. Insurance can help defray the loss to municipal buildings, contents and equipment.

Other Funds

- The Federal Housing and Urban Development Program offers annual Community Development Block Grants (CDBG) and after Irene the program released Community Development Block Grants – for Disaster Recovery (CDBG – DR). Contact ACCD for more information: http://accd.vermont.gov/strong_communities/opportunities/funding/cdbqdr
- Of particular importance: CDBG funds can be used to match the federal portion of FEMA Hazard Mitigation Grants.
- Artists and artisans may be able to get support after a disaster from Craft Emergency Relief Fund/Artists Emergency Resources (CERF+): <http://craftemergency.org/> CERF+ offers direct financial and educational assistance to craft artists including emergency relief assistance, business development support, and resources and referrals on topics such as health, safety, and insurance.

mitigation projects in capital improvement plans and to pursue hazard mitigation steps.

- Municipal Plans and land use bylaws will incorporate clear community standards regarding flood resiliency, which will guide Act 250 and Section 248 decisions.

RUTLAND RPC GOALS

- Assist communities in identifying and designating flood hazard areas.
- Designate those areas to be protected, including floodplains, river corridors, lands adjacent to streams, wetlands, and upland forests, to reduce the risk of flood damage to infrastructure and improved property.
- Assist communities in mitigating risks to public safety, critical infrastructure, historic structures and municipal investments.
- Encourage communities to avoid development in flood hazard, fluvial erosion and river corridor protection areas.
- Encourage communities to adopt flood hazard bylaws.
- Promote natural areas, non-structural outdoor recreational and agricultural uses as the preferred land uses within river corridor areas.
- Encourage moving or abandoning roads in flood hazard areas when there

are more cost effective solutions or other routes.

- Promote river corridor protection and support phase two data for updates.
- Encourage communities to adopt “no adverse impact” standards.
- Promote river corridor easements to help farmers accommodate the need for river channel adjustments.
- Encourage emergency preparedness and flood response planning.
- Identify community goals to enhance information dissemination and public understanding.
- Directly engage and include community in identifying safer locations for community development and encouraging growth in those locations.

RUTLAND RPC ACTIONS

The Rutland Regional Planning Commission shall achieve these goals through assisting communities to develop bylaws and town plans; regional approval of town plans; participating in Act 250 and Section 248 processes, training and education, information dissemination, preparing funding applications, and GIS mapping.

Emergency Relief Assistance Fund (ERAF) (2014 Changes)

12.5% state funding for communities which have adopted:

1. National Flood Insurance Program (participate or have applied);
2. Town Road and Bridge Standards – (annually certify adopted standards that meet or exceed the standards in the current: 2014-2016 VTrans Orange Book: Handbook for Local Officials);
3. Local Emergency Operations Plan (adopt annually after town meeting);
4. Local Hazard Mitigation Plan - Adopt a FEMA- approved local plan (valid for five years). Or, a draft plan has been submitted to FEMA Region 1 for review.
5. **17.5%** state funding for communities which also:
6. Protect River Corridors from new encroachment; or, protect their flood hazard areas from new encroachments and participate in the FEMA Community Rating System.